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Multi Scale Modeling of Honey Comb Sandwich Panels Using FEA

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***Abstract*:** Honeycomb structures are finding huge applications in automobile and aerospace these days due to their lightweights with high specific stiffness compared to traditional materials and a lot of research is going in modeling the honeycomb structures for user defined applications. Due to its wide variations in the geometry, coupon testing of these specimens goes beyond the time and cost allocations for the projects in industries. Virtual testing is the next alternative with which the models are simulated using numerical methods, but many times involves huge computational efforts due to their intricate shapes and features involved.

The idea is to come up with an analysis technique that can provide the information of global structure at a local level so that one can check the feasibility of the idea going to be implemented. Multi scale modeling proves to be an ideal approach to address the above issue with adaptive modeling and scale connecting capability

Key words- Honey comb, multi-scale, adaptive modeling.

1. INTRODUCTION

Sandwich boards with honeycomb core are broadly utilized in various auxiliary applications, for example, air ship floor boards, control surfaces, outside radomes, get to boards, rocket blades, structural building structures and some more. The primary issue in breaking down honeycomb center sandwich structures utilizing Therefore, we utilize the regular practice in the limited component displaying of honeycomb center sandwich structures.

Substitution of the real honeycomb center by an equal continuum demonstrate functions admirably the limited component strategy lies in the considerable computational exertion that must be spent in displaying and breaking down a sandwich structure with a multi-cell development center by keeping up the real honeycomb center geometry. Particularly in issues including worldwide auxiliary investigation, for example, redirection, vibration or air versatile examination of structures made of sandwich development, In these issues, the worldwide solidness match of the sandwich structure with the comparable continuum demonstrate and the sandwich structure with the genuine honeycomb center is the principle objective. . Here, by utilizing a limited component demonstrate with a proportionate continuum center, we decide the neighborhood stretch circulation in the center and in the face-sheet material associating with the center since the genuine geometry isn't safeguarded in the equal mode.

2. MANUSCRIPT

The objectives of this paper is to (1) develop a general finite element model using commercially available software to study the deformation & stress of honeycomb sandwich panels, (2) compare the results with a normal plate and plate with honey comb (3) Compare the results with respective to fixed and cantilever beam of honey comb structure (3) identify key responses that can clearly differentiate the amount of stresses and deformation

3. ILLUSTRATIONS

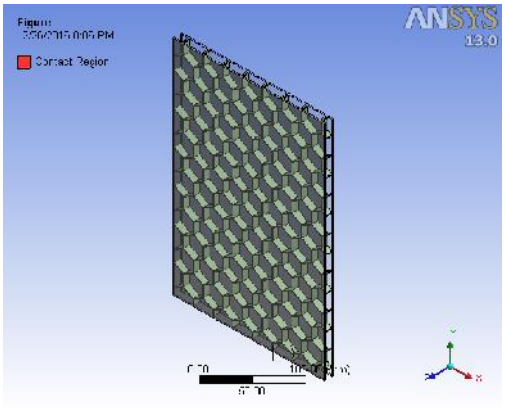


Fig.1 Sandwich panel with honey comb structure

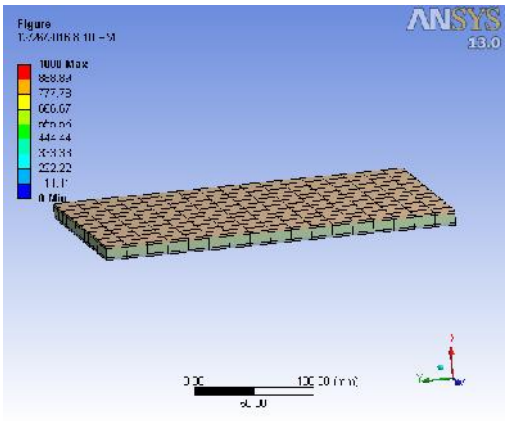


Fig.2 Sandwich panel with honey comb structure

4. FEA ANALYSIS:

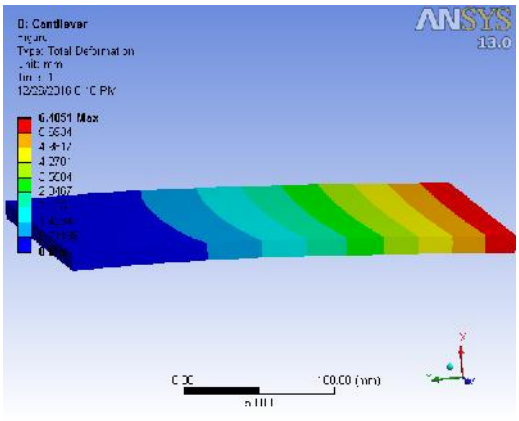
To assess the effective stresses and deformation of honeycomb cores a finite element model of the sandwich panel with the honeycomb geometry and facesheets is required. In this study a finite element model of the sandwich panel is named as the reference model. Figure 1 depicts the typical reference and equivalent core finite element models of sandwich panels which are used in the assessment study.The equivalent honeycomb core models are evaluated based on finite element analyses of the sandwich panels. Finite element analyses are conducted by imposing input load in the y-direction. And also the panel is taken for different cases like fixed beam and cantilever beam and by varying the geometry i.e taking the honey comb structure in between the sand which plates and comparing the results with the general structure.

5.Material properties:

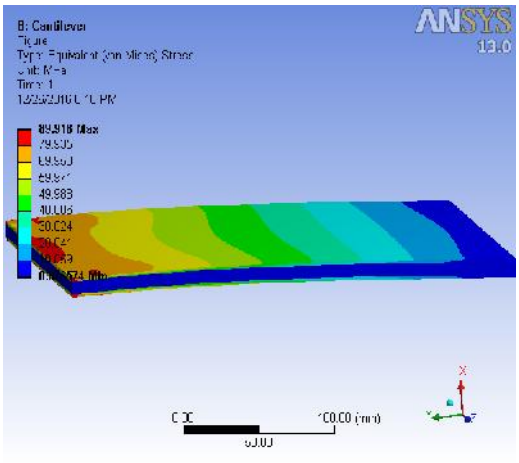
s.no	Material	Youngs modulus	Rigidity modulus	Bulk modulus	Poissons ratio
1	Al	69000	25940	67647	0.33
2	Hpp	1300	457.75	2708.3	0.42

6.Results &Discussions :

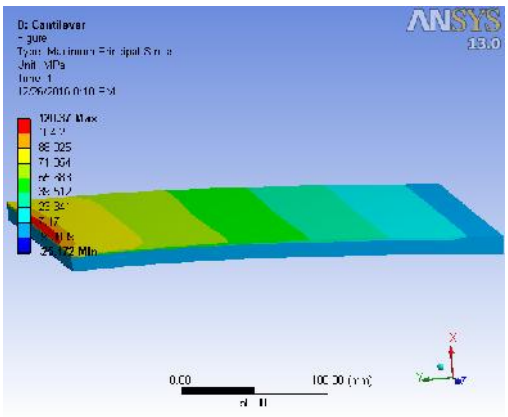
Case-1: Deformation of model without honey comb structure on cantilever



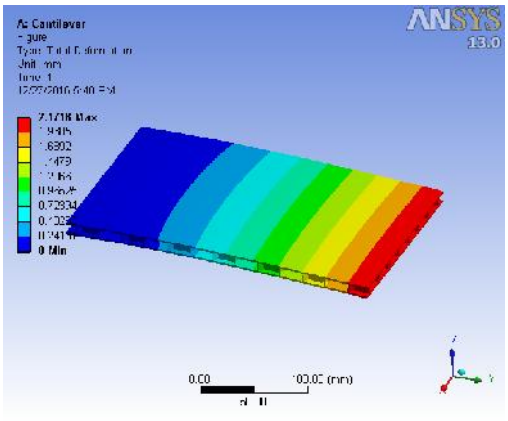
Case-1: Von-Mises Stress of model without honey comb structure on cantilever



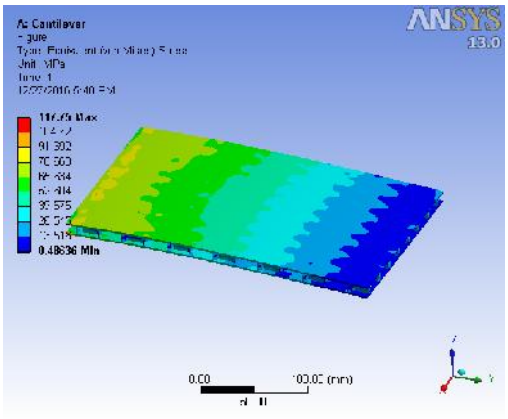
Case-1: Max Principal Stress of model without honey comb structure on cantilever



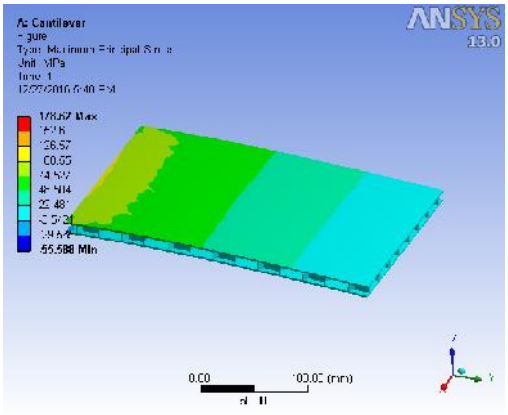
Case-2: Deformation of model with honey comb structure on cantilever



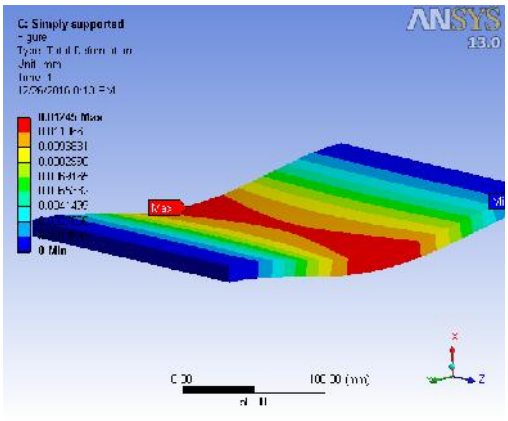
Case-2: Von-Mises Stress of model with honey comb structure on cantilever



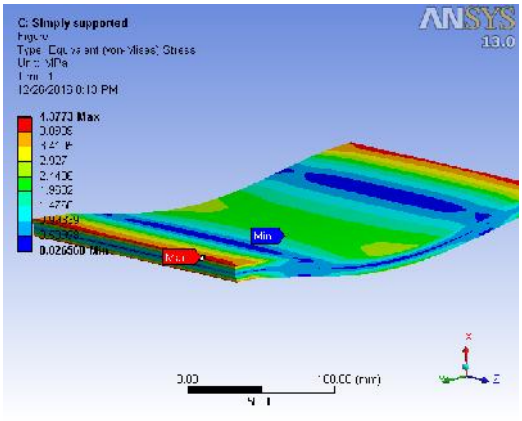
Case-2: Max Principal Stress of model with honey comb structure on cantilever



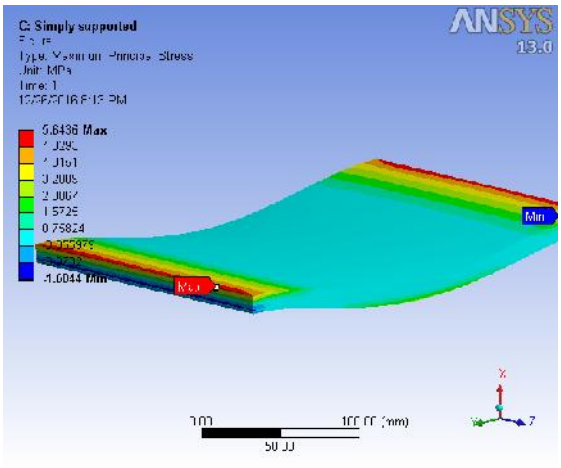
Case-3: Deformation of model without honey comb structure on fixed support



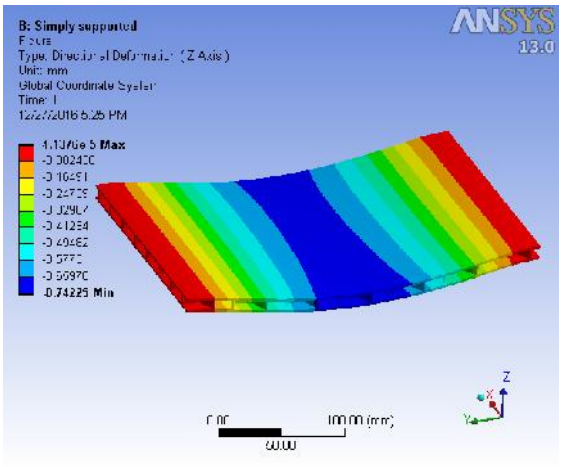
Case-3: Von-Mises Stress of model without honey comb structure on fixed support



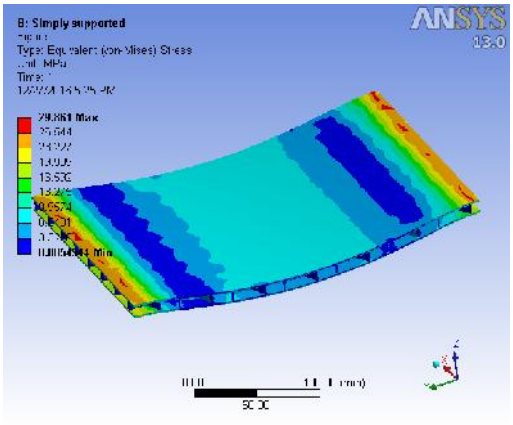
Case-3: Max Principal Stress of model without honey comb structure on fixed supports



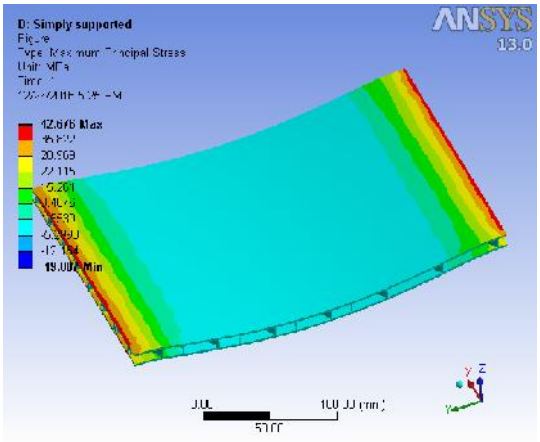
Case-4: Deformation of model with honey comb structure on fixed support



Case-4: Von-Mises Stress of model with honey comb structure on fixed support



Case-4: Max Principal Stress of model with honey comb structure on fixed supports



7. Comparison of Results:

s.no	Load applied	Type	Cantilever Support	
			Without honey comb	With honey comb
1	1000N	Deformation(mm)	6.4051	2.1718
2	1000N	Principal stress (mpa)	120.37	178.62
3	1000N	Von-Mises stress (mpa)	89.918	117.75

s.no	Load applied	Type	Fixed Support	
			Without honey comb	With honey comb
1	1000 N	Deformation(mm)	$1.245X10^{-2}$	$4.137X10^{-5}$
2	1000 N	Principal stress (mpa)	5.6436	42.676
3	1000 N	Von-Mises stress (mpa)	4.3773	29.961

8.Conclusion:

This paper has presented the comparison for sandwich panels for different geometrical approaches like the general sandwich panels with face sheet and the sandwich panels with honeycomb structure. The honey comb structure are considered as hexagonal in shape and by taking two cases one is for a cantilever support and the other for a fixed support the variation of deformation ,stresses are done by using FEA approach. And it is observed that when polypropylene material is used in both the cases the deformation in honey comb sandwich panel is less than the sandwich panel without honey comb structure.

References:-

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